News

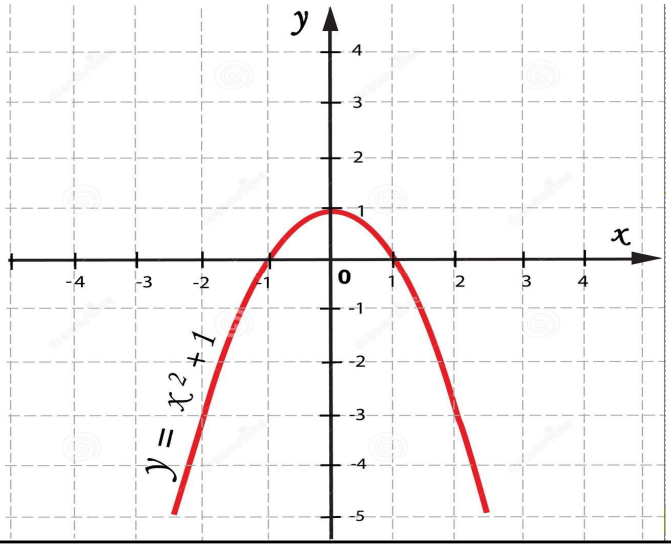
Blackjack and Wordle tournaments tonight, 6:30pm, Lo Schiavo G12

If you have not held or scheduled a Project01 interview with me, you are late

- Please do so ASAP

CS112 –
Java
Programming

Java Math functions



Java Math functions

The **Java Math library** includes many useful functions for working with numbers.

Online-search "java math" for reference or for specific functions

Some useful functions:

- Trig: sin(), cos(), tan(), asin(), acos(), atan(), etc
- Powers: sqrt(), pow(), exp(), log(), log10()
- Conversions: abs(), ceil(), floor(), max(), min(), round()
- Constants: Math.E, Math.PI

Java Math Functions

```
double angle = Math.PI / 2.0;

System.out.println(Math.sin(angle)); // angle in RADIANS
```

Math Conversion Functions

```
Math.ceil(2.1); // "next biggest" integer
```

3.0

```
Math.ceil(3.0);
```

3.0

```
Math.round(2.5);
```

3.0

```
Math.round(-2.5);
```

-2.0

CEILING(): "smallest integer that is >= argument"
FLOOR is similar

Round() rounds "towards +infinity"

Suppose we want to round but not to 1?

```
// Want PI to 3 decimal places

final double scalefactor = 1000.0;

double roundedPi = Math.round(Math.PI * scalefactor) / scalefactor;

System.out.println(roundedPi);
```

3.142

Interlude

Wordle – duplicated letters problem

How would we solve on whiteboard? Mystery = “apple”. Guess = “hoppy”, “puppy”

Random Numbers

Why would we want a computer to make random numbers?

Simulate or study processing of random inputs

Can computers make random numbers?

Not exactly, but…

PSEUDORANDOM NUMBERS
BASE OFF TIME OF DAY OR TIME OF RANDOM KEY CLICKS
WORK VERY WELL—in Java. Not so much in the old days, esp Windows.

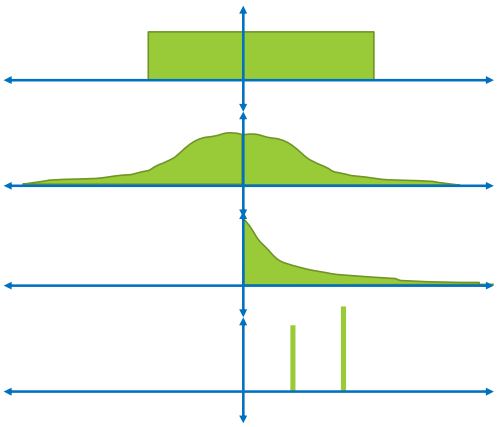
(Pseudo) Random numbers have a Distribution

Uniform

Gaussian

Exponential

Binomial



Java Random library

```
import Java.util.Random;
Random myGenerator = new Random();
myGenerator.nextDouble(); // pseudorandom number in [0.0, 1.0)
myGenerator.nextGaussian(); // "normal" Gaussian values
```

If we want Exponential, Binomial, Poisson, etc we must create them ourselves.

nextInt(), nextLong(), nextBoolean(), etc.
nextInt(UpperLimit) – useful!

Typealong Project

```
class Dice
```

Six sided die
Constructor defaults to 1 die, but takes arg to allow >1
What methods do we want?

- roll() – for games like Liars Dice, need all die values, in an int array?
- total() – sum of all values

Introduction to Sorting

Bubble Sort

Sorting

Things we sort must be comparable

- 8 < 9 < 15 < 101 < 4196

Sorting in Python was easy

```
values = [44, 13, -105, 71, 8]
values.sort()
print(values)
```

"Comparable" is an "Interface" in Java (look up online!)
Sorting puts them into order!

Sorting in Java

There is a built-in sort() method in Java also

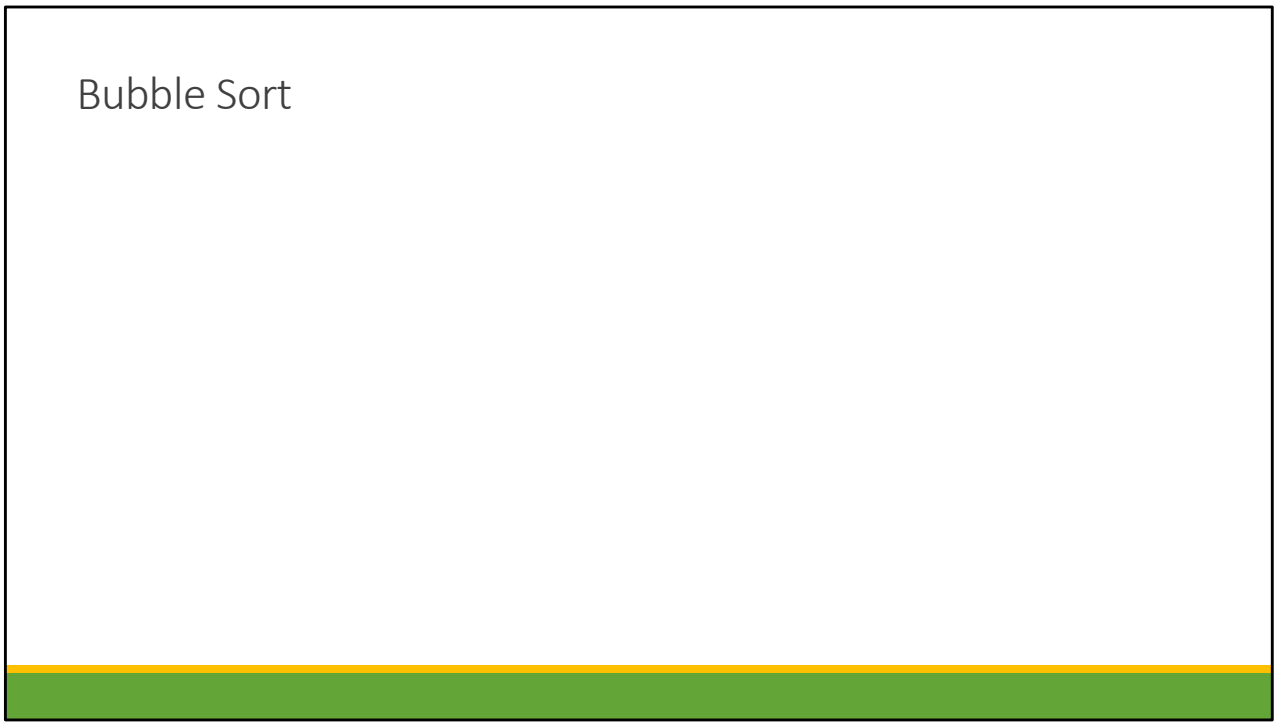
- Will learn about it in a week

But how do these functions actually work?

LOTS OF DIFFERENT WAYS TO DO SORTING

- Simple and complicated, fast and slow, lots of memory or a little
- We will study more methods in a few weeks, when we learn about recursion
- My real-world sort problem: bubble sort too slow with 1 MHz CPU

Bubble Sort



5, 1, 4, 1, 2, 8
Show technique on board visually
Then write code
Why called Bubble Sort? Largest values "bubble toward the top"

Bubble Sort

```
int length = 100;
int[] data = new int[length];
SetRandomData(data);

for(int endPoint = length-1; endPoint >= 1; --endPoint) {
     for(int j = 0; j < endPoint; j++) { // each little step
          if (data[j] > data[j+1]) { // do we swap?
               Swap(data, j, j+1);
          }
     }
}
```

Lab19